



Pipe ExplorerTM Surveying System

Technology Need:

Radiological surveys of pipes are normally accomplished by passing a hand-held radiological sampling instrument over the exterior surface of a pipe. For a complete survey, this requires personnel to gain access to the entire exterior surface of the pipe over its full length. Access is frequently restricted and the process is difficult, time consuming, potentially hazardous, and not readily capable of detecting threshold surface contamination values.

Technology Description:

Using a technique applied to borehole instrumentation emplacements (SEAMISTTM), the Pipe ExplorerTM system integrates standard radiation detectors with a unique inverting membrane deployment method. The deployment method utilizes a long, tubular membrane to tow instruments through the pipes.

The membrane is initially rolled up on a reel inside of a pressure-tight canister. The membrane exits the canister at the bottom and is wrapped back on the base-pipe and clamped. As pressurized air is introduced into the canister, the membrane inverts and



distends out of the base-pipe. The membrane continues to invert until its end is completely distended. A tether attached to the end of the membrane is then reeled up to retrieve the system, in reverse fashion.

To inspect the inside of pipes for radionuclide contamination, a gamma and/or beta radiation detector is mounted at the point where the tether is attached to the membrane. As the detector traverses the pipe, pulled by the advancing membrane, electrical pulses proportional to radioactivity on the surface are transmitted through a cable back to the canister and subsequently to a data acquisition system. Pulses are either simply counted for a gross contamination scan, or analyzed with a multi-channel pulse-height analyzer to determine their energy and hence, the specific radioisotope.

The primary nuclear detectors that are used with the deployment system are sodium iodide and cesium iodide scintillation detectors coupled to photomultiplier tubes for gamma measurements. For beta measurements, an organic scintillator coupled to a photomultiplier tube was used. Since alpha particles cannot penetrate the membrane, a scintillating material is embedded into the membrane for specific alpha surveys. This scintillation is then detected by a photodiode located inside the membrane, which keeps the photodiode shielded from outside contamination. These detectors are configured in compact packages small enough to be transported around bends and obstructions in piping systems.

The detectors have been integrated with the inverting membrane deployment method so that the system can be used to inspect pipes with inside diameters 2 inches and greater. The system can be used in piping runs up to 500-ft long with and without multiple elbows and obstructions. The system control and data acquisition

are remotely operable.

Benefits:

- ▶Rapid, accurate radiological data over entire pipe length
- ▶Survey of locations inaccessible with previously existing technology
- ▶The Pipe Explorer™ membrane prevents contact of measurement equipment with pipe surfaces while it reduces worker contact with contaminated materials
- ▶The Pipe Explorer™ system deploys at faster speeds than the baseline technologies is able to navigate around elbows and obstructions in pipes (up to 50% blockage)
- ▶Contamination is not moved with the detector, eliminating the possibility of false readings

Status and Accomplishments:

Two complete deployment systems have been developed that incorporate 4 types of beta/gamma detectors, alpha detectors, video cameras, and pipe locators. The Pipe Explorer™ has been demonstrated and deployed at multiple DOE and non-DOE sites. Science & Engineering Associates, Inc. (SEA) is now actively marketing Pipe Explorer™ services to DOE and commercial nuclear facilities.

Demonstrations of this technology include:

- ▶Idaho National Environmental and Engineering Laboratory (INEEL) - FY 1995
- ▶Argonne National Lab (CP-5) - FY 1996
- ▶Los Alamos National Laboratory - FY 1998

Deployments of this technology include:

- ▶General Motors Adrian Plant (Adrian, MI) - FY1995
- ▶Grand Junction (Colorado) Site - FY 1996
- ▶Inhalation Toxicology Research Institute (Albuquerque, NM) - FY 1996
- ▶Mound Site (Miamisburg, OH) - FY 1997

- ▶Argonne National Laboratory (CP-5 Reactor) - FY 1997
- ▶Portland Gas and Electric Trojan Nuclear Plant (Portland, OR) - FY 1998
- ▶Crystal River (Florida) Nuclear Power Plant - FY 1998
- ▶Columbus Environmental Management Project (Columbus, OH) - FY 1999 & FY 2000
- ▶Brookhaven National Laboratory - FY 1999
- ▶Savannah River Site (SRS) - FY 1999
- ▶SRS Four Mile Branch Project - FY 2000
- ▶SRS Lower Three Runs Operations Project - FY 2000

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 74
<http://ost.em.doe.gov/tms>

The National Energy Technology Laboratory Internet address is <http://www.netl.doe.gov>

For more information on this technology, please visit SEA's website at <http://seabase.com>

An Innovative Technology Summary Report (ITSR) for the Pipe Explorer™ technology is available at <http://ost.em.doe.gov/afd/ddfa/itsrs/itsr74/itsr74.pdf>